SOUTHERN CALIFORNIA PARTICULATE CENTER SUPERSITE (SCPCS)

Progress Report for Period January 15-April 15, 2000

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1. Introduction

The overall objective of the Southern California Particle Center Supersite (SCPCS) is to conduct research and monitoring that contributes to a better understanding of the measurement, sources, size distribution chemical composition and physical state, spatial and temporal variability and health effects of suspended particulate matter (PM) in the Los Angeles Basin (LAB). The research objectives of the SCPCS are:

1. To characterize PM, its constituents and precursors, to better understand sources and transport affecting human exposure and to support development of State Implementation Plans (SIPs).
2. To obtain atmospheric measurements to support health studies designed to address causal factors, etiologic pathways and mechanisms of PM related morbidity and mortality with particular emphasis on PM source-receptor-exposure-effects pathways.
3. To conduct methods testing that will enable comparisons and evaluation of different technologies for characterizing PM including evaluation of new instrumentation, sampling methods and federal reference methods.

This report addresses the period between January 15, 2000 – April 15, 2000.

2. Particle Instrumentation Unit (PIU)

An essential component of this 5-year program is the construction of a mobile Particle Instrumentation Unit (PIU). This unit is equipped with a variety of state-of-the-art particle and gaseous pollutant measurement technologies and will be deployed in 5 or more discrete areas of the Los Angeles Basin to conduct intensive aerosol measurements that go beyond the traditional $PM_{2.5}$ mass, sulfate and nitrate concentrations. These areas will be chosen to provide a wide geographical coverage, and thus to be as representative as possible of human exposures to these pollutants. The PIU will provide a detailed description of ambient aerosol concentrations and chemical characteristics with particle size at various sampling locations across the Los Angeles basin. The data will be used to conduct investigations of the effects of ambient temperature, relative humidity, wind speed and direction, and concentration of gaseous co-pollutants on particle size and chemical composition and will help identify locations within the Los Angeles Basin where high concentrations of possible PM toxic agents or their surrogates can be found.

The PIU will also provide aerosol measurement simultaneously with toxicology studies using a transportable aerosol concentrator facility which one or more of the possible toxic agents are enriched relative to the rest of the PM. These activities link the Supersite program to PM Center research, and to the mobile concentrator facility funded by the California Air Resources Board (ARB).

The PIU trailer has been ordered from Wells-Cargo, Inc. and was delivered to UCLA on March 30, 2000. The trailer is 20' x 8' x 12' and has a counter along one wall with multiple sample inlets in the ceiling above the bench. We obtained all the necessary approvals for initial siting of the trailers at UCLA in the courtyard of Warren Hall for a period of 90 days starting on April 1, 2000. This period is for the installation of equipment, modification of trailers, calibration of equipment, and shakedown runs.

We have received almost all major pieces of sampling equipment and direct reading instruments, which include the following:

Continuous PM Monitors

1. Scanning Mobility Particle Sizer (SMPS 3936, TSI Inc.)
2. Aerodynamic Particle Sizer (APS 3310, TSI Inc.)
3. PM_{10} and $PM_{2.5}$ Tapered Element Oscillating Microbalance (TEOM Model 1400, R&P, Inc.)
4. $PM_{2.5}$ Continuous Ambient Mass Monitor (CAMM; Babich et al, 1999)
5. Continuous nitrate, sulfate and carbon monitor (ADI/R&P)
6. Real-Time Ambient Mass (RAM) Monitor (DataRAM, Mie Inc.)
7. The 'dual channel' AE2x series (Andersen RTAA-900)

Time-integrated PM Monitors

1. Two Micro-Orifice Uniform Deposit Impactor (MOUDI, MSP Corp.)
2. One Rotating Version of Micro-Orifice Uniform Deposit Impactor (MOUDI, MSP Corp.)
3. High-Volume In vitro Particle Concentrator (this is one of our portable concentrators)
4. PM_{10} and $PM_{2.5}$ FRM (Partisol, R&P, Inc)
5. PM_{10} and $PM_{2.5}$ Honeycomb Denuders Samplers (HDS)
6. PM_{10} Organic Denuder Sampler (URG Inc)

Hering Low-Pressure Impactor
High-Volume TE-6001 Size Selective Inlet (SSI) PM_{10} inlet (Tisch Environmental Inc,)

Gas Monitors

1. Continuous Chemiluminescence Analyzer (Monitor Labs Model 8840)
2. Thermo Environmental Inc. Model 48C trace level
3. UV photometer (Dasibi Model 1003 AH)

Meteorological Parameter Monitors

1. Vaisala Model MP113Y temperature and relative humidity monitor
2. Met One High-Sensitivity Wind vane
3. Met One High Sensitivity Anemometer

We have started calibration of our PIU samplers and monitors. The SMPS and APS have been calibrated using monodisperse aerosols (size range 0.05-10 μm) and the response of the instruments (expressed in terms of mass concentration readings) has been compared to gravimetrically determined concentrations. The response of the MIE DataRAM monitor has been evaluated in collocation to 3 identical DataRAM monitors in limited field studies conducted at Rancho Los Amigos. All four samplers operated under the same conditions, sampling the same aerosol. The mass concentrations of the four samplers were within ± 5%.

We have also started a comprehensive evaluation of a modified DataRAM nephelometer for providing real-time mass concentration measurements and to assess the effect of particle size and chemical composition on the relationship between the response of the photometer and the actual aerosol mass concentration. The DataRAM is used with a diffusion dryer in its inlet in order to exclude the contribution of the aqueous component of $PM_{2.5}$ to the overall mass concentration measured by the instrument. In their nominal configuration, light scattering photometers sample $PM_{2.5}$ at ambient RH, or have used heated inlets which would cause excessive volatilization of labile PM constituents. The performance of this modified nephelometer will be compared to the actual $PM_{2.5}$ concentration and the effect physico-chemical PM characteristics, such as chemical composition and particle size distribution, on the DataRAM-to-gravimetric mass concentration will be investigated.

At present, we are conducting a series of experiments in which we are using ambient air in the environment of UCLA as the test aerosol to compare the PM-10 and PM-2.5 concentrations measured by SMPS/APS, Partisol, MOUDI, TEOM, DataRAM, and HDS monitors.

3. Sampling in our First PIU Site (Rancho Los Amigos Medical Center)

Initial siting of the trailers at UCLA in the courtyard of Warren Hall will last for a period of 90 days starting on April 1, 2000. This period is for the installation of equipment, modification of trailers, calibration of equipment, and shakedown runs. It is anticipated that by late June, 2000, the PIU trailer will be moved to Rancho Los Amigos National Rehabilitation Center in south central Los Angeles, which will be our first site of our SCPCS sampling program. We have received approval for space allocation at Rancho. Two sites on the grounds of Rancho have been identified as potential candidates for placing our two trailers. In both sites, the maintenance staff of Rancho Los Amigos has already installed the necessary power and water supplies that will be used to operate the trailers. Both sites are within less than 1 km from a nearby freeway (710) and thus particularly attractive to conduct our inhalation studies to concentrated particulate matter.

We have already stated part of our PM sampling at Rancho Los Amigos, in conjunction with ongoing human inhalation exposure studies to concentrated PM. These studies are part of our PM Center Toxicology investigations. Our current sampling scheme involves 24-hour averaged, size-fractionated measurements of ambient and concentrated PM mass and chemical

composition. Sampling is conducted every 6th day and efforts are made to have it coincide with the NAMS and AQMD schedules.

To-date we have conducted 6 runs since March 15, 2000. In each run, we have used three collocated Micro-Orifice Uniform Deposit Impactor (MOUDI) to group PM into the following size ranges:

- 0.01-0.15 μm (ultrafine particles)
- 0.15-0.4 μm (accumulation mode, "condensation" sub-mode)
- 0.4-1.0 μm (accumulation mode, "droplet" sub-mode)
- 1.0-2.5 μm ("intermediate" mode)
- 2.5-10 μm (coarse particles)

In addition of mass, the following components have been measured for these size groups:

a. inorganic ions (i.e., sulfate, nitrate, ammonium)
b. trace elements and metals
c. elemental and organic carbon (EC/OC) content
d. concentrations of polycyclic aromatic hydrocarbons (PAH)

Ambient data are averaged over 24 hours, whereas data corresponding to concentrated PM are only averaged over two hours, as this is the typical duration of the human exposures conducted simultaneously with PM sampling.

4. QA/QC Progress

In the Southern California Particle Center and Supersite we are committed to collecting high quality data and their careful documentation. Quality Assurance is an integral part of the Center and is developing concurrently with acquisition and installation of instrumentation. As instrumentation is accepted and integrated into the sampling platform, standard operating procedures and maintenance protocols are prepared based on the manufacturer's recommendations, level of usage, and field operator experience. This documentation is kept in a central location for reference use, with selected sections readily available on-board the PIU.

We have identified key professional personnel to oversee and direct the quality assurance/quality control aspects of the program's operation. Deputy Director, Dr. Steven D. Colome will have overall responsibility for the QA/QC program of the SCPCS and Professor Ed Avol will serve as the internal QA/QC Supersite officer. Dr. Rong Chun Yu will serve as the data management coordinator and will have responsibility for data collection, management and archiving elements of the data QC. These individuals have demonstrated prior experience in the performance of these tasks and are currently active in their respective roles. To provide an external independent auditing of our field measurement operations, we are considering options to contract with an outside expert in QA/QC assessment. Several contractors have been contacted, and negotiations are presently underway. We expect to have a contractor identified within a few months.

In an effort to maintain comparability with other Supersites, we have requested and received SOPs from the Fresno Supersite for instrumentation and measurements that are essentially

identical in both sampling locales. We are in the process of reviewing those and will adopt or modify the Fresno Supersite SOPs with the intent of maintaining as similar an operating protocol as our protocol and scope of work permits. We have also reviewed the following four documents in planning our QA/QA efforts:

(1) EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, Interim Final, November 1999.

(2) Guidance for the Data Quality Objectives Process, EPA QA/G-4, September, 1994.

(3) Quality Planning Handbook: North American Research Strategy for Tropospheric Ozone, ORNL/CDIAC-111, April 1998.

(4) Quality Assurance Project Plan for the Southern Oxidant Study Atlanta Supersite Field Experiment, November 1999.

Working with the QA/QC Committee and the EPA QA Manager, Mr. Dennis Mikel, we will be developing the QA/QC documentation for the Southern California Particle Center and Supersite in a manner commensurate with the other Supersites.